

NOTE ON THE CORRECTION OF THE CALCUTTA STANDARD BAROMETER  
TO THE KEW AND GREENWICH STANDARDS—*by* H. F. BLANFORD.

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One of the greatest drawbacks to the value of the Meteorological observations that have hitherto been recorded in India, and one which has gone far to render the large majority of them worthless for advancing our knowledge of the Meteorology of the country, has arisen from the neglect of observers and those charged with the collection of such data, to ensure the reduction of their observations to one common standard. Without this, it is obvious that they cannot be treated comparatively, and any deductions that may be attempted from a comparison of registers must always lie open to the suspicion that the variations they may show are not real, but due to instrumental and perhaps other errors. This is especially the case with registers of atmospheric pressure. As I have more than once pointed out, the variations of this important element are so small in India, that the persistent barometric gradient of a monsoon, existing at any moment between two stations five hundred miles apart, may be entirely concealed or even reversed in appearance by the uncorrected errors of the instruments in use. It follows that one of the first duties of any officer who may have to supervise the working of a system of meteorological registration, is to ensure that the barometers are carefully compared with some well known local standard, before they are used for the purpose of registration; and that the comparison be repeated from time to time, in order to detect and eliminate errors, which may arise from accidental disturbance or progressive deterioration.

In Bengal, and to some extent in the N. W. Provinces and Central India, the barometer by Newman, No. 84, at the Surveyor General's Office in Calcutta, has been adopted as the standard to which the local observations are corrected. But whether there is any constant difference between this instrument and the standards in use elsewhere, has hitherto been a matter of conjecture. At the present day, most good instruments sent out from England have been compared with the Kew Standard barometer constructed

by Professor Balfour Stewart, and in Ceylon, for instance, at the observatories established two years ago by Captain Fyers, the barometric registers are corrected to the readings of the Kew Standard.

The receipt, some months ago, of a number of very excellent standard barometers by Casella, which had been compared at the India Store Department with a Standard, the error of which to those of Kew and Greenwich had been previously ascertained, has afforded me an opportunity of ascertaining indirectly the difference of the Calcutta standard from these latter instruments, and thus obtaining a correction which will render the barometric registers of Northern India more rigorously comparable than heretofore with those of Ceylon and other places. The comparison, as will be seen, is very indirect, but it has I think been sufficiently extensive to prevent any appreciable error arising from the cause, always assuming that the India Store Department Standard is accurately corrected to those of Kew and Greenwich.

The instruments which have afforded the means of this comparison are of the form figured in Messrs. Casella's catalogues, with tubes of about 0.3 inch internal diameter. Eight of them have been compared by myself with Newman's Standard, No. 94. They were compared one at a time, placed side by side with the latter instrument, and each was read simultaneously with the Newman, nine (in two cases ten) times during the diurnal period of rising, and an equal number of times during that of falling pressure. By this means the correction for capillarity, always more or less uncertain, is eliminated. The readings of each instrument have been reduced for temperature by those of its own attached thermometer, so that the corrections obtained include those, if any, of the thermometers. The total number of comparative readings is 146. The results of this comparison are given in the following table.

The error of Newman's barometer, No. 94, with the standard at the Surveyor General's Office has been ascertained as follows. The former instrument was compared by Babu Gopinath Sen before I received it three years ago, and the mean error of 13 reduced readings then determined to be  $-.0245$ . A series of levels, from the ground floor of my house to that of the observatory, shewed

the difference of level of the cisterns to be 0·2 foot, my barometer being the lower. This represents a barometric difference of + 0·0002 which must be deducted from the readings of my own standard in its present situation. Of the 146 comparative readings, 73 were made at even hours, simultaneously with the readings of the Surveyor General's Standard, and these give a mean difference of No. 94 = No. 84 (— .0249). The readings were made at intervals between January 7th and August 23rd, the barometric range in this period being from 30·141 to 29·371. The error of No. 94 to No. 84 has therefore evidently remained constant, and may be taken with sufficient approximation as — 0·0251.

The following table gives the results obtained with the several Casella's barometers.

*Results of a comparison of eight barometers with Newman's No. 94, the Kew and Greenwich Standards.*

	No. of Casella's barometer.	Error to No. 94.			Error to Kew.	Error to Green- wich.
		Rising.	Falling.	Mean.		
		Inch.	Inch.	Inch.	Inch.	Inch.
	628	+ .0132	+ .0159	+ .0145	— .001	+ .003
	632	+ .0188	+ .0158	+ .0173	+ .005	+ .009
	637	+ .0202	+ .0211	+ .0206	+ .006	+ .010
	627	+ .0193	+ .0188	+ .0190	+ .006	+ .010
	634	+ .0148	+ .0171	+ .0159	+ .002	+ .006
	635	+ .0209	+ .0235	+ .0222	+ .004	+ .008
	630	+ .0137	+ .0163	+ .0150	+ .001	+ .005
	631	+ .0181	+ .0203	+ .0192	+ .005	+ .009

The error of No. 94, (my office standard) to those of Kew and Greenwich, is obtained in each case by changing the signs and taking the difference of the figures in column 4 and those in columns 5 and 6 respectively. The results, with two exceptions, are, I think, sufficiently accordant to afford an assurance of the general trustworthiness of the mean result.

*Error of Newman's No. 94 to the Kew and Greenwich Standards.*

Casella's barometer.		With Kew.	With Greenwich.
	No.	Inch.	Inch.
By	628	— .0155	— .0115
„	632	— .0123	— .0083
„	637	— .0146	— .0106
„	627	— .0130	— .0090
„	634	— .0139	— .0099
„	635	— .0182	— .0142
„	630	— .0140	— .0100
„	631	— .0142	— .0102

If we reject the results afforded by barometers No. 632 and No. 635 which depart somewhat widely from the remainder, the mean of the remaining six comparisons gives the error of Newman's No. 94 — .0142 to the Kew, and — .0102 to the Greenwich Standard. Deducting these from the error, above given, of the same barometer to the Calcutta Standard, and changing the sign, we have the error of the Calcutta Standard as follows:—

Error of Calcutta Standard, Newman, No. 84.

To Kew.

To Greenwich.

+ .0109.

+ .0149.

These amounts, or say .011 and .015 inch, must therefore be deducted from the readings of the Calcutta Standard and all registers corrected thereto, to render them comparable with registers corrected to the Kew and Greenwich Standards respectively.

ON INDIAN AND MALAYAN TELPHUSIDÆ, PART I,—

by JAMES WOOD-MASON, ESQ.

(Continued from page 297).

(With Plate XXVII).

TELPHUSA EDWARDSII, n. sp., pl. xxviii, figs. 11—15.

Carapace sparingly hirsute above, more thickly so on the pleural region, broadest along a line dividing the anterior from the